APACHE HIGHLANDS SOUTH

The Apache Highlands South Ecoregion, including 8.5 million acres in Arizona, is best known among the scientific community for its "sky islands." Over 20 mountain ranges cloaked in pine-oak woodland and mixed conifer forests rise abruptly from surrounding basins comprised of grassland and desertscrub to form forested islands among a "desert sea" (Marshall 1957; Marshall and others 2004; Warshall 1995). These have also been called the "Madrean archipelago" for their resemblance to a chain of islands extending off the "continent" of the Sierra Madre (DeBano and others 1995). The elevation ranges from about 2200 to 10,717 feet, averaging about 4340 feet. Precipitation varies from about 10 to 30 inches per year according to elevation, with slightly more falling in summer than winter.

Because of the variation in elevations as well as the location between the Sierra Madre to the south (Neotropic influence) and the Rocky Mountains to the north (Nearctic influence), an unusually rich fauna and flora exist here (Marshall and others 2004; Warshall 1995). At least 468 bird species (including accidental and casual migrants) have been verified in southeastern Arizona during the past 50 years, along with more than 240 butterfly species (Bailowitz and Brock 1991; Edison and others 1995).

Historically, land use in the Apache Highlands South Ecoregion consisted mainly of cattle ranching, with small areas of agriculture where water was available. Most of the private lands were homesteaded, and almost all of the public and state trust lands were leased to ranchers for grazing.

Ranching continues to be a dominant land use, even as human population growth in the ecoregion climbs. The major urban area of southeastern Arizona is Tucson, in the Sonoran Desert Ecoregion, but its growth is encroaching into the adjacent Apache Highlands South Ecoregion. Other communities in the ecoregion are also growing, including Nogales, Douglas, Sierra Vista, Benson, Willcox, Bisbee, Tombstone, Patagonia, Sonoita, Arivaca, Rio Rico, and Oracle. As people find new ways to telecommute, and as the number of retired people in the state increases, there is increased demand for rural housing. These changing human pressures across the ecoregion have resulted in habitat fragmentation due to roads and new urban and rural development. Concomitantly, as more people come to the area, there is an increased demand for recreational opportunity on public lands in the ecoregion, leading to high use on lands that were previously lightly impacted by man. These pressures will continue to pose a problem for maintaining biodiversity.

Land uses and conservation opportunities vary across the region, reflecting the pattern of land ownership. Many of the major mountain ranges in the ecoregion are federal lands, with a large majority managed by the Coronado National Forest; thus, many of the mountain habitats are at lowered risk of permanent development. Nevertheless, federal lands are threatened by increased recreational use, habitat fragmentation by roads and other human activities, unauthorized roads and trails, mining, invasive species, historic overgrazing, insect infestations, and unnatural fire regimes.

The situation is different in the lowland basins between the mountains, which include many private and State Trust lands. These valleys are topographically suitable for urban and rural development, and they provide climate suitable for human habitation. In addition to the effects of continuing widespread development, the lowlands continue to be impacted by the same issues as mountain communities, including increased recreational use, historic overgrazing, and unnatural fire regimes. Degraded grasslands continue to be susceptible to shrub encroachment.

Aquatic systems, including rivers, streams, creeks, cienegas, and wetlands, and their associated riparian habitats, support a disproportionately high number of wildlife species. The San Pedro River is the most important perennial river in the ecoregion, with considerable value to wildlife. The ecoregion also includes a portion of the upper Gila River from the border with New Mexico to the mouth of the San Francisco River, an effluent-supported portion of the Santa Cruz River north from the Mexican Border, and numerous important riparian streams such as Sonoita Creek and Cienega Creek. Willcox Playa and Whitewater Draw, both ephemeral wetlands, are important for many species of wildlife, particularly sandhill cranes and waterfowl. Healthy riparian habitat associated with these aquatic systems in Apache Highlands South provides migratory birds and pollinating insects and bats with critical trans-hemispheric travel corridors.

The Apache Highlands South also has significant pressure from uses related to the border with Mexico. Large numbers of illegal immigrants pass through the Apache Highlands South seeking work opportunities in the United States. Illegal drugs are smuggled across the Mexico border. Because interdiction is most effective in the urban border areas, the illegal traffic has been funneled into the wildlands, and this traffic is having significant impacts on wildlife and wildlife habitat. Law enforcement efforts to track, apprehend, and deter illegal traffic are having their own adverse impacts on natural habitats. In many instances, border activities have destroyed habitat and provided a barrier along the wildlands of our border. The impact to wildlife due to borderland activities is significant.

Pressures from historical and current land use, human population increases, and border issues have put communities in Apache Highlands South under considerable threat. Note that the descriptions provided do not attempt to depict conditions on sovereign tribal lands. For an expanded description of each habitat type and characterization of statewide threats to each, see "Statewide Condition of Arizona's Terrestrial and Riparian/Aquatic Habitat Types (Element 2)." See Appendix O for scoring of all stressors in each habitat type. The descriptions provided do not attempt to depict conditions on sovereign tribal lands. The nature of these stressors in Arizona is presented more fully under "Stressors that Impact Wildlife and Wildlife Habitats (Element 3)." These communities represent an important natural resource for Arizona, with an extremely high level of biodiversity due to Madrean and Petran influences. Maintaining the full variety of biotic communities in Apache Highlands South will be a challenge in the face of increasing threats.

Species of Greatest Conservation Need (Element 1)

For more information on these species, see "Conservation Actions to Address Stressors to SGCN (Elements 3, 4)." A complete list of species, including those of lower conservation priority and

of undetermined vulnerability status can be found in Appendix G. For some species in Table 17, this part of their distribution may not represent a key area for conservation actions.

Table 17. Tier 1a and 1b SGCN associated with each habitat type in Apache Highlands South.

		Desert-scrub	Grassland		Woodlands/ Forests					Human-dominated landscapes*	Aquatic & Riparian		
ScientificName	Common	Chihuahuan	Semidesert	Plains & Great Basin	Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer	Petran Subalpine		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Amphibians													
Ambystoma tigrinum stebbinsi	Sonoran Tiger Salamander			X		X						X	X
Eleutherodactylus augusti cactorum	Western Barking Frog		X			X		X					
Gastrophryne olivacea	Great Plains Narrow-mouthed Toad		X			X					X	X	
Pternohyla fodiens	Lowland Burrowing Treefrog		X								X	X	
Rana blairi	Plains Leopard Frog		X			X						X	
Rana chiricahuensis	Chiricahua Leopard Frog	X	X	X		X		X			X	X	
Rana subaquavocalis	Ramsey Canyon Leopard Frog		X			X					X	X	
Rana tarahumarae	Tarahumara Frog					X					X	X	
Rana yavapaiensis	Lowland Leopard Frog	X	X	X	X	X		X			X	X	
Birds													
Accipiter gentilis apache	Apache Northern Goshawk				X	X	X	X	X		X	X	X
Accipiter gentilis atricapillus	Northern Goshawk				X	X	X	X	X		X	X	X
Aechmophorus clarkii	Clark's Grebe									X	X	X	X
Aimophila botterii	Botteri's Sparrow		X	X						X			
Amazilia violiceps	Violet-crowned Hummingbird					X				X	X	X	
Ammodramus bairdii	Baird's Sparrow		X	X						X			

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ScientificName	Common	Chihuahuan	Semidesert	Plains & Great Basin	Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer	Petran Subalpine Conifer		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Ammodramus savannarum ammolegus	Arizona Grasshopper Sparrow		X	X						X			
Ammodramus savannarum perpallidus	Western Grasshopper Sparrow		X	X						X		X	
Anthus spragueii	Sprague's Pipit		X	X						X			
Ardea alba	Great Egret									X	X	X	X
Asturina nitida maxima	Northern Gray Hawk									X	X	X	X
Botaurus lentiginosus	American Bittern									X	X	X	X
Buteo regalis	Ferruginous Hawk	X	X	X						X			
Buteogallus anthracinus	Common Black-Hawk				X	X				X	X	X	X
Caracara cheriway	Crested Caracara		X							X			
Catharus ustulatus	Swainson's Thrush	X			X	X	X	X	X	X	X	X	
Ceryle alcyon	Belted Kingfisher									X	X	X	X
Charadrius alexandrinus nivosus	Western Snowy Plover									X	X		X
Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo					X	X			X	X	X	X
Colinus virginianus ridgwayi	Masked Bobwhite		X							X			
Contopus cooperi	Olive-sided Flycatcher	X	X	X	X	X	X	X	X	X	X	X	X
Dendrocygna autumnalis	Black-bellied Whistling-Duck									X	X	X	X
Dumetella carolinensis	Gray Catbird									X	X	X	X
Egretta thula	Snowy Egret									X	X	X	X

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ScientificName	Common	Chihuahuan	Semidesert	Plains & Great Basin	Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer	Petran Subalpine		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Empidonax fulvifrons pygmaeus	Northern Buff-breasted Flycatcher					X	X	X			X	X	
Empidonax traillii extimus	Southwestern Willow Flycatcher	X				X				X	X	X	X
Falco femoralis septentrionalis	Northern Aplomado Falcon		X								X	X	X
Falco peregrinus anatum	American Peregrine Falcon	X	X	X	X	X	X	X	X	X	X	X	X
Glaucidium brasilianum cactorum	Cactus Ferruginous Pygmy-Owl		X							X	X	X	X
Haliaeetus leucocephalus	Bald Eagle		X	X						X	X	X	X
Ictinia mississippiensis	Mississippi Kite		X							X	X	X	
Oreoscoptes montanus	Sage Thrasher	X	X	X			X			X			
Pachyramphus aglaiae	Rose-throated Becard					X					X		X
Pandion haliaetus	Osprey									X	X	X	X
Pinicola enucleator	Pine Grosbeak							X	X				
Polioptila nigriceps	Black-capped Gnatcatcher		X								X		
Progne subis arboricola	Western Purple Martin									X	X		X
Rhynchopsitta pachyrhyncha	Thick-billed Parrot					X		X					
Sialia sialis fulva	Azure Bluebird			X		X	X	X		X	X	X	X
Sphyrapicus nuchalis	Red-naped Sapsucker				X	X	X	X	X	X	X	X	X
Strix occidentalis lucida	Mexican Spotted Owl				X	X	X	X	X		X	X	
Trogon elegans	Elegant Trogon					X	X	X	X		X	X	

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Tyrannus crassirostris	Thick-billed Kingbird										X	X	X
Tyrannus melancholicus	Tropical Kingbird		X							X	X	X	X
Fish													
Agosia chrysogaster	Longfin Dace										X	X	
Campostoma ornatum	Mexican Stoneroller										X		
Catostomus bernardini	Yaqui Sucker										X		
Catostomus clarki	Desert Sucker										X		
Catostomus insignis	Sonora Sucker										X		
Catostomus latipinnis	Flannelmouth Sucker										X		
Cyprinella formosa	Beautiful Shiner										X		X
Cyprinodon macularius	Desert Pupfish										X	X	
Gila ditaenia	Sonora Chub										X		
Gila intermedia	Gila Chub										X	X	
Gila purpurea	Yaqui Chub										X	X	X
Gila robusta	Roundtail Chub										X		
Ictalurus pricei	Yaqui Catfish										X		X
Meda fulgida	Spikedace										X		
Oncorhynchus gilae apache	Apache (Arizona) Trout										X		
Poeciliopsis occidentalis occidentalis	Gila Topminnow										X	X	
Poeciliopsis occidentalis sonoriensis	Yaqui Topminnow										X	X	

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ScientificName	Common	Chihuahuan	Semidesert	Plains & Great Basin	Interior Chaparral	Madrean Evergreen	Great Basin Conifer	Petran Montane Conifer	Petran Subalpine Conifer		Streams/ Rivers	Wetlands/ Springs	Lakes/ Reservoirs
Ptychocheilus lucius	Colorado Pikeminnow										X		
Rhinichthys osculus	Speckled Dace										X		
Tiaroga cobitis	Loach Minnow										X		
Xyrauchen texanus	Razorback Sucker										X		
Crustaceans and Mollusks													
Anodonta californiensis	California Floater										X	X	X
Oreohelix grahamensis	Pinaleno Mountainsnail							X	X				
Pyrgulopsis arizonae	Bylas Springsnail											X	
Pyrgulopsis bernardina	San Bernardino Springsnail											X	
Pyrgulopsis thompsoni	Huachuca Springsnail											X	
Sonorella christenseni	Clark Peak Talussnail							X	X				
Sonorella grahamensis	Pinaleno Talussnail							X	X				
Sonorella imitator	Mimic Talussnail							X	X				
Sonorella macrophallus	Wet Canyon Talussnail							X	X				
Stygobromus arizonensis	Arizona Cave Amphipod											X	
Tryonia gilae	Gila Tryonia											X	
Mammals													
Choeronycteris mexicana	Mexican Long-tongued Bat	X	X	X	X	X	X	X			X	X	X
Cynomys ludovicianus	Black-tailed Prairie Dog	X	X	X									
Euderma maculatum	Spotted Bat					X	X	X	X		X	X	X

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Eumops perotis californicus	Greater Western Mastiff Bat	X	X	X	X	X	X	X	X				X
Eumops underwoodi	Underwood's Mastiff Bat			X		X							
Lasiurus blossevillii	Western Red Bat	X	X	X		X	X	X			X	X	
Lasiurus xanthinus	Western Yellow Bat	X	X	X	X	X	X	X			X	X	
Leopardus pardalis	Ocelot	X	X	X	X	X	X	X			X	X	
Leptonycteris curasoae yerbabuenae	Lesser Long-nosed Bat	X	X	X	X	X	X	X					
Macrotus californicus	California Leaf-nosed Bat	X		X	X	X	X				X	X	
Microtus longicaudus leucophaeus	White-bellied Long-tailed Vole					X							
Nyctinomops macrotis	Big Free-tailed Bat			X		X	X				X	X	X
Ovis canadensis mexicana	Desert Bighorn Sheep	X	X	X								X	
Panthera onca	Jaguar	X	X	X	X	X	X	X				X	
Peromyscus merriami	Mesquite Mouse			X									
Sciurus nayaritensis chiricahuae	Chiricahua Fox Squirrel					X		X			X	X	
Sorex arizonae	Arizona Shrew					X	X	X				X	
Tamiasciurus hudsonicus grahamens	Mt Graham Red Squirrel							X	X				
Thomomys umbrinus intermedius	Southern Pocket Gopher					X							
Reptiles													

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Aspidoscelis arizonae	Arizona Striped Whiptail		X										
Aspidoscelis stictogrammus	Giant Spotted Whiptail				X						X		
Aspidoscelis xanthonota	Red-back Whiptail		X										
Crotalus pricei pricei	Western Twin-spotted Rattlesnake							X	X				
Crotalus willardi obscurus	New Mexico Ridge-nosed Rattlesnake					X							
Crotalus willardi willardi	Arizona Ridge-nosed Rattlesnake		X	X		X		X					
Gopherus agassizii (Sonoran Population)	Sonoran Desert Tortoise	X	X		X	X							
Gyalopion quadrangulare	Thornscrub Hook-nosed Snake		X			X							
Kinosternon arizonense	Arizona Mud Turtle		X			X					X	X	X
Kinosternon flavescens	Yellow Mud Turtle	X	X			X					X	X	
Lampropeltis triangulum celaenops	New Mexico Milksnake		X										
Oxybelis aeneus	Brown Vinesnake		X			X							
Sceloporus slevini	Slevin's Bunchgrass Lizard		X	X		X		X	X				
Sistrurus catenatus edwardsii	Desert Massasauga		X	X									
Terrapene ornata luteola	Desert Box Turtle	X	X	X									
Thamnophis eques megalops	Northern Mexican Gartersnake										X	X	X

*Human-dominated landscapes here refer to agricultural areas and urban lakes. These habitat types are discussed

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under "Statewide Condition of Arizona's Terrestrial and Aquatic/Riparian Habitat Types," and in "Stressors to Arizona's Wildlife and Wildlife Habitat" under the stressor "Urban/rural development."

Habitat types below are arranged in order of prevalence in this ecoregion. Where patches of uncharacteristic habitat types (not described in this section) occur in this ecoregion, conservation should reflect stressors and species identified in neighboring ecoregions.

Semidesert Grassland
(61.0% of acreage)

Habitat Condition (Element 2)
This is the most common habitat in the ecoregion and covers most of the lowlands. The majority of the Semidesert Grassland is State Trust Lands and private lands. Most of these lands have a long history of intensive cattle grazing. The condition of this vegetation community is generally poor due to loss of grass species and an increase in the shrub component. There are several separate issues involved in restoration of this habitat type, and the scientific community has different opinions on potential for restoration. Some scientists believe that native grasses cannot be restored because of changes in soil characteristics and lowering of the water table. Some places have been restored with long periods of decreased grazing pressure; however, grazing rest or reduction is generally not occurring on most State Trust and private lands. Drought and climate change impact the ability of this vegetative community to recover. Natural fire, which historically maintained this community, no longer occurs in much of the habitat due to lack of grasses to carry the fire. A natural fire regime is not likely to be restored on most of the Semidesert Grassland because of continued grazing pressure and development of human communities within the habitat type. There have been some successes at restoring Semidesert Grassland with herbicides to reduce shrubs and thereby promote grasses, but these efforts have been on a small scale and expensive. High human use, both because of the increasing human population and because of heavy border activity, is degrading the habitat and decreasing the value of the habitat for wildlife. In some places, introduced nonnative plants (for example, Lehmann lovegrass) have invaded the natural vegetation and caused ecosystem changes that may not be reversible. In places where nonnative grasses have become established, unnaturally *high*

fire regime is established, which furthers the spread and dominance of the nonnatives. Most of the Semidesert Grassland in Arizona exists in the Apache Highlands South Ecoregion, so the responsibility for conservation of this community lies within this ecoregion. In the long term, it is unlikely that the majority of Semidesert Grassland will be maintained for wildlife values. Instead, conservation goals should focus on protection of some of the Semidesert Grassland from development and restoration of these lands to ecological function.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Abiotic resource use**
Mining
Stressor Category: **Border issues**
Enforcement fences along the border
Enforcement activities along the border
Unauthorized roads & trails created by illegal immigrants and smugglers
Altered fire regime as a result of border activities
Light pollution along the border
Illegal dumping/littering along the border
Dispersed camping along the border
Stressor Category: **Changes in Ecological Processes**
Unnatural fire regimes
Streambank alteration/channelization
Habitat degradation/shrub invasions
Soil erosion
Habitat fragmentation/barriers
Loss of keystone species
Stressor Category: **Climate Change**
Drought
Shift to warmer climate
Stressor Category: **Consumptive use of biological resources**
Harvesting/collecting animals
Grazing by ungulates
Stressor Category: **Habitat conversion**
Livestock management
Rural development
Stressor Category: **Invasive species**
Nuisance plants
Disease/pathogens/parasites
Feral animals
Stressor Category: **Non-consumptive resource use**
Off-range recreational shooting
Motorized recreation off-trail
Stressor Category: **Transportation and infrastructure**
Unauthorized roads & trails
Roads for motorized vehicles

Right-of-way fencing along roadways

Madrean Evergreen Woodland
(18.1% of acreage)

Habitat Condition (Element 2)
This vegetative community covers the bulk of the mountainous habitats in Apache Highlands South. This ecoregion contains the majority of the Madrean Woodlands in Arizona, so responsibility for conservation of this habitat lies in this ecoregion. Historically, this community was characterized by open oak woodland, interspersed with native grasses. Due to lack of a natural fire regime, this community is currently denser than natural, and species that are not adapted to natural fire (for example, juniper) have increased. Historic overgrazing reduced grasses, which resulted in the lack of fire. Federal land managers are reducing grazing pressure and restoring natural fire, but it will take many years to restore natural conditions at a landscape level. Most of this habitat is public land managed by the Coronado National Forest, but some portions of the community are private, State Trust, BLM, San Carlos Apache Nation, and NPS lands. Conservation of this habitat should focus on managing grazing at a sustainable level and restoration of a natural fire regime, which will restore grasses and decrease shrub density. High human use, both because of the increasing human population and because of heavy border activity, is degrading the habitat and decreasing the value of the habitat for wildlife.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Abiotic resource use**
Mining
Stressor Category: **Border issues**
Enforcement activities along the border
Enforcement fences along the border
Dispersed camping along the border
Unauthorized roads & trails created by illegal immigrants and smugglers
Illegal dumping/littering along the border
Altered fire regime as a result of border activities
Stressor Category: **Changes in Ecological Processes**
Insect Infestation
Soil erosion
Habitat fragmentation/barriers
Unnatural fire regimes
Habitat degradation/shrub invasions
Stressor Category: **Climate Change**
Shift to warmer climate
Drought
Stressor Category: **Consumptive use of biological resources**
Grazing by ungulates
Harvesting/collecting animals
Stressor Category: **Habitat conversion**

Livestock management
Rural development

Stressor Category: **Invasive species**

Feral animals
Disease/pathogens/parasites
Nuisance plants

Stressor Category: **Non-consumptive resource use**

Motorized recreation off-trail
Non-motorized recreation off-trail
Off-range recreational shooting

Stressor Category: **Transportation and infrastructure**

Roads for motorized vehicles
Trails for foot, bike, or equine use
Unauthorized roads & trails
Right-of-way fencing along roadways

Chihuahuan Desertscrub
(15.3% of acreage)

Habitat Condition (Element 2)

This community also fills some of the valleys in the Apache Highland South, but is not as extensive as the Semidesert Grassland. Land ownership is State Trust Land, BLM, and private. Like Semidesert Grassland, most of these lands have been historically overgrazed and degraded by human uses. Historically, this community had more of a grass component than currently and more variety in the shrub community. In places, this community has degraded to a monoculture of tarbush (*Flourensia cernua*) or a combination of a few unpalatable shrubby species (for example, *Prosopis*, *Larrea*, *Gutierrezia*, *Happlopappus*) that is very resistant to change. Restoration of this community will be difficult if not impossible, due to low rainfall and poor soils. Drought and climate change impact the ability of Chihurhuan desertscrub to recover. In a few small places, restoration has been accomplished by use of herbicide to kill shrubs and encourage grasses. Rural development and border activites are having impacts on wildlife habitat. A reasonable conservation goal is to protect some of the Chihuahuan Desertscrub from development and to restore these lands to ecological function.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Border issues**

Disease along the border
Dispersed camping along the border
Enforcement activities along the border
Enforcement fences along the border
Light pollution along the border
Altered fire regime as a result of border activities
Unauthorized roads & trails created by illegal immigrants and smugglers
Illegal dumping/littering along the border

Water use/contamination from illegal immigrants and drug smugglers

Stressor Category: **Changes in Ecological Processes**

Habitat fragmentation/barriers
Habitat degradation/shrub invasions
Streambank alteration/channelization
Soil erosion

Stressor Category: **Climate Change**

Drought
Shift to warmer climate

Stressor Category: **Consumptive use of biological resources**

Harvesting/collecting animals
Grazing by ungulates

Stressor Category: **Habitat conversion**

Rural development
Livestock management

Stressor Category: **Non-consumptive resource use**

Motorized recreation off-trail

Stressor Category: **Transportation and infrastructure**

Roads for motorized vehicles
Unauthorized roads & trails
Right-of-way fencing along roadways

Interior Chaparral
(2.1% of acreage)

Habitat Condition (Element 2)

This habitat is found in a few isolated pockets in the Apache Highlands South, primarily on the western edge of some mountains, and additionally as the major vegetative component of the Santa Teresa Mountains. Current condition of most of this habitat is probably poor, due to lack of low-growing plants and lack of litter. This habitat requires periodic fire to maintain biodiversity, and lack of fire has resulted in increased shrub density. In this shrub-dominated degraded stage, livestock grazing further represses restoration of grasses. There are many landowners in the Chaparral habitat; a large portion is part of the San Carlos Apache Nation, and another large piece is federal land managed by the Coronado National Forest. Other chaparral communities are private, State Trust Land, and federal lands managed by NPS (Saguaro National Park) and BLM. Currently, some natural fires are allowed to burn in Chaparral habitat, which should help to restore the community, but landscape changes will require time.

Major Stressors Affecting Habitat Type (Element 3)

Stressor Category: **Changes in Ecological Processes**

Habitat degradation/shrub invasions
Soil erosion
Unnatural fire regimes
Domestication of wildlife/game farming

Loss of keystone species
Habitat fragmentation/barriers

Stressor Category: **Climate Change**
Drought
Shift to warmer climate

Stressor Category: **Consumptive use of biological resources**
Grazing by ungulates

Stressor Category: **Invasive species**
Disease/pathogens/parasites

Stressor Category: **Non-consumptive resource use**
Motorized recreation off-trail
Off-range recreational shooting

Stressor Category: **Transportation and infrastructure**
Roads for motorized vehicles

Plains and Great Basin Grassland
(2% of acreage)

Habitat Condition (Element 2)

This community is found in a few isolated locations in the Apache Highlands South Ecoregion, but the value of this habitat to grassland species of wildlife is significant, particularly for pronghorn and grassland birds. Historically, this grassland was characterized by an open grassland structure with little shrub component. Although these lands have been grazed historically and are grazed currently, most are in relatively good ecological condition and still provide significant wildlife functions and values. Restoration of a natural fire regime is important to maintaining the function of these grasslands and to reducing shrub invasion. Land ownership in Plains and Great Basin Grassland is a combination of USFS, BLM, State Trust Lands, and private. The most threatened Plains and Great Basin Grassland in this ecoregion is the area around Sonoita, which is mainly private- and State-owned. Rural development here is usually ranchette-type development, where homes are scattered widely throughout the grassland. This type of development threatens wildlife habitat because of fragmentation, roads, fencing, intensive grazing on small parcels, and inability to maintain natural fire frequency. Human activities related to illegal border traffic, enforcement and recreation are impacting the wildlife habitat.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Border issues**
Enforcement activities along the border
Dispersed camping along the border
Enforcement fences along the border
Illegal dumping/littering along the border
Light pollution along the border
Unauthorized roads & trails created by illegal immigrants and smugglers
Altered fire regime as a result of border activities

Stressor Category: **Changes in Ecological Processes**
Soil erosion
Habitat degradation/shrub invasions
Habitat fragmentation/barriers
Unnatural fire regimes
Loss of keystone species

Stressor Category: **Climate Change**
Drought

Stressor Category: **Consumptive use of biological resources**
Grazing by ungulates
Harvesting/collecting animals

Stressor Category: **Habitat conversion**
Rural development
Urban growth
Livestock management

Stressor Category: **Invasive species**
Disease/pathogens/parasites
Nuisance plants

Stressor Category: **Non-consumptive resource use**
Motorized recreation off-trail

Stressor Category: **Transportation and infrastructure**
Roads for motorized vehicles
Unauthorized roads & trails
Right-of-way fencing along roadways

Montane Conifer Forest
(1.3% of acreage)

Habitat Condition (Element 2)
This habitat exists on the tops of the following mountains in the ecoregion: Santa Teresa, Pinaleño, Galiuro, Winchester, Chiricahua, Huachuca, Santa Rita, Rincon, and Santa Catalina. This is an important habitat type for the ecoregion because of the isolated sky island communities. Virtually all of these habitats are on public land managed by the Coronado National Forest, with the exceptions of habitat in the Huachuca Mountains managed by Fort Huachuca, in the Santa Teresas within the San Carlos Apache Nation, and in the Rincon Mountains managed by Saguaro National Park. Historically, the Montane Conifer Forest was characterized by a more open forest community. Its condition is currently considered degraded due to the lack of fire and the related high density of trees. The fire regime in this habitat type has been considerably altered by forest fire suppression and long-term livestock grazing that largely eliminated fine fuels. The unnaturally high density of trees has caused catastrophic fires and forest pest outbreaks, which have further degraded the forest. Currently, grazing pressures are being reduced by land managers, and federal agencies are starting to manage fire for resource conservation, allowing natural fire to return. However, it is expected to take many years to improve the condition of the forests, and in the interium these forest are at continued risk of catastrophic fire and disease.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Border issues**
Dispersed camping along the border
Unauthorized roads & trails created by illegal immigrants and smugglers
Illegal dumping/littering along the border
Altered fire regime as a result of border activities

Stressor Category: **Changes in Ecological Processes**
Soil erosion
Unnatural fire regimes
Insect Infestation

Stressor Category: **Climate Change**
Shift to warmer climate
Drought

Stressor Category: **Invasive species**
Disease/pathogens/parasites

Great Basin Conifer Woodland
(0.2% of acreage)

Habitat Condition (Element 2)
Small pockets of this habitat exist in the Apache Highlands South near Aravaipa and Klondyke, between the Santa Teresa and northern Galiuro Mountains. Larger portions of this habitat exist in other ecoregions of the state. The condition of Great Basin Coniferous Woodland throughout Arizona is that it is increasing in extent at the expense of grassland and riparian habitats. This reflects the combined impacts of altered fire regimes and intensive domestic livestock use over the past 100 years. In this ecoregion, management of this habitat type would be most successful for wildlife if developed as part of the adjacent grasslands and woodlands.

This habitat type is found primarily in Apache Highlands North and Colorado Plateau, with some representation in this ecoregion. The following major stressors were assessed for this habitat type in Apache Highlands North. The important stressors listed below reflect impacts of historical land uses as well as increasing human population and pressure for outdoor recreational opportunities for people living within the ecoregion and in neighboring metropolitan Phoenix.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Changes in Ecological Processes**
Habitat fragmentation/barriers
Unnatural fire regimes
Loss of keystone species
Domestication of wildlife/game farming
Habitat degradation/shrub invasions
Soil erosion

Stressor Category: **Climate Change**
Shift to warmer climate
Drought
Stressor Category: **Consumptive use of biological resources**
Grazing by ungulates
Stressor Category: **Invasive species**
Disease/pathogens/parasites
Stressor Category: **Non-consumptive resource use**
Motorized recreation off-trail
Off-range recreational shooting
Stressor Category: **Transportation and infrastructure**
Roads for motorized vehicles

Subalpine Conifer Forest
(0.05% of acreage)

Habitat Condition (Element 2)
Two small pockets of this community exist in the Apache Highlands South: a significant mountaintop in the Pinaleño Mountains and a small area in the Chiricahua Mountains. Both habitats are managed entirely by the Coronado National Forest. Because of the rarity and isolation of these mountaintops in the Apache Highlands South, these habitats are critical for conservation and for listed and sensitive species. Historically, this forest was characterized by large old fire-sensitive trees in a generally even-aged stand. The subalpine forest was insulated from fire by the surrounding lower-elevation fire-resistant mixed conifer, which historically burned regularly but not catastrophically; the mixed conifer was thinned naturally by fire, and fire did not usually invade into the wetter subalpine spruce fir forest. With the current unnaturally high tree density in mixed conifer, and the resulting high fuel loads, the subalpine conifer forest is now being lost to fire and disease. This community is critically in danger in Apache Highlands South. Natural resource agencies are working together to accomplish restoration by protecting this community from further fire and disease, but threats are still significant

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Changes in Ecological Processes**
Unnatural fire regimes
Soil erosion
Insect Infestation
Stressor Category: **Climate Change**
Drought
Shift to warmer climate
Stressor Category: **Invasive species**
Disease/pathogens/parasites

Riparian and aquatic systems in Apache Highlands South include:

Wetlands/Springs/Seeps

Habitat Condition (Element 2)

Wetlands, springs, and seeps are rare in the Apache Highlands South, and all are critical to maintain. Important wetland habitats are the San Bernardino National Wildlife Refuge, Arivaca Cienega, Whitewater Draw, and Willcox Playa. Historically, wetlands were more numerous in Apache Highlands South than today; these communities have been lost to water diversion, lowered water tables, grazing and agricultural use, dams and reservoirs, and numerous other human uses. Many natural springs have been tapped for livestock or domestic use. Those few wetlands, springs and seeps that exist today are impacted by the same historical uses and also by heavy recreational and border activities. Today the value of these wetlands if more fully appreciated, and conservation efforts focus on wetlands. Nevertheless, functions and values are difficult to restore in places where hydrology has changed and the water table has lowered. Nonnative species have invaded and replaced native species in many wetlands. In spite of conservation efforts, restoration of wetlands, springs and seeps in Apache Highlands South will continue to be a challenge; demands for precious water resources continue to grow.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Abiotic resource use**
- Groundwater depletion and springhead use
- Water diversion/water catchments
- Mining

Stressor Category: **Border issues**
- Disease along the border
- Altered fire regime as a result of border activities
- Dispersed camping along the border
- Enforcement activities along the border
- Illegal dumping/littering along the border
- Unauthorized roads & trails created by illegal immigrants and smugglers
- Water use/contamination from illegal immigrants and drug smugglers

Stressor Category: **Changes in Ecological Processes**
- Streambank alteration/channelization
- Soil erosion
- Habitat degradation/shrub invasions
- Unnatural fire regimes
- Habitat fragmentation/barriers
- Loss of keystone species
- Management for game animals and sport fish
- Altered river flow regimes

Stressor Category: **Climate Change**
- Shift to warmer climate
- Drought

Stressor Category: **Consumptive use of biological resources**

Grazing by ungulates

Stressor Category: **Habitat conversion**

Urban growth
Dams/reservoirs/impoundments
Livestock management
Rural development
Recreational sites/facilities
Military bases, defoliation, munitions testing

Stressor Category: **Invasive species**

Bait-bucket dumping/illegal stocking
Nuisance plants
Disease/pathogens/parasites
Hybridization
Nuisance animals

Stressor Category: **Non-consumptive resource use**

Battles, maneuvers, war games, military camps, guerilla insurgencies
Dispersed camping
Scientific research and collection
Motorized recreation off-trail

Stressor Category: **Pollution**

Heavy metals/mine tailings
Sediment/ash flows
Pesticides/herbicides

Stressor Category: **Transportation and infrastructure**

Roads for motorized vehicles
Canals/pipelines
Unauthorized roads & trails

Streams/Rivers

Habitat Condition (Element 2)

Rivers in Apache Highlands South include the San Pedro River, a portion of the Gila River from the New Mexico border to the mouth of the San Francisco, the Babocomari River, and the Santa Cruz River from the headwater in the San Rafael Valley and in the effluent-supported perennial stretch north of Nogales. All streams are important to wildlife conservation, and include Cienega Creek, Sonoita Creek, Red Rock Canyon, Sycamore Canyon in the Pajarito Mountains, O'Donnell Creek, Leslie Canyon, and numerous mountain streams in the Pinaleños, Chiricahuas, Huachucas, Santa Catalinas, and Galiuros. Historically, rivers and streams had more water for longer periods, had higher water tables, and had greater vegetation. Water was less channelized, and flowed through slower, maintaining the water table. Historic accounts document rivers as wide valleys with grass up to the belly of a horse and water seeping and weaving through the grass. Today, many rivers are dry, downcut riverbeds, carrying water only during flood events. Water tables are far lower today than historically; perennial water and riparian vegetation cannot be supported. In spite of interagency planning efforts, Apache Highlands South continues to lose streams and rivers. July 2005 was the first time on record that zero water flow was recorded in

the San Pedro River at the Charleston gaging station. It is feared that the San Pedro could dry, chiefly as a result of groundwater pumping, much as the Santa Cruz River dried in the Tucson basin. Because of the increasing human demand for water, it will be difficult to maintain existing streams and rivers or to restore historic sites.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Abiotic resource use**
- Mining
- Groundwater depletion and springhead use
- Water diversion/water catchments

Stressor Category: **Border issues**
- Altered fire regime as a result of border activities
- Illegal dumping/littering along the border
- Water use/contamination from illegal immigrants and drug smugglers
- Unauthorized roads & trails created by illegal immigrants and smugglers
- Enforcement activities along the border
- Disease along the border
- Dispersed camping along the border

Stressor Category: **Changes in Ecological Processes**
- Loss of keystone species
- Streambank alteration/channelization
- Altered river flow regimes
- Soil erosion
- Management for game animals and sport fish
- Unnatural fire regimes
- Habitat fragmentation/barriers
- Habitat degradation/shrub invasions

Stressor Category: **Climate Change**
- Drought
- Shift to warmer climate

Stressor Category: **Consumptive use of biological resources**
- Grazing by ungulates

Stressor Category: **Habitat conversion**
- Rural development
- Livestock management
- Military bases, defoliation, munitions testing
- Dams/reservoirs/impoundments
- Urban growth
- Recreational sites/facilities

Stressor Category: **Invasive species**
- Bait-bucket dumping/illegal stocking
- Nuisance plants
- Nuisance animals
- Hybridization

Disease/pathogens/parasites

Stressor Category: **Non-consumptive resource use**

Battles, maneuvers, war games, military camps, guerilla insurgencies
Scientific research and collection
Motorized recreation off-trail
Dispersed camping

Stressor Category: **Pollution**

Lead shot/fishing line
Nutrients/algal blooms
Heavy metals/mine tailings
Sediment/ash flows
Pesticides/herbicides

Stressor Category: **Transportation and infrastructure**

Canals/pipelines
Unauthorized roads & trails
Roads for motorized vehicles

Lakes/Reservoirs

Habitat Condition (Element 2)

Small man-made lakes exist in the ecoregion: Patagonia Lake, Parker Canyon Lake, Peña Blanca Lake, Arivaca Lake, Riggs Lake, Frye Mesa Reservoir and Rose Canyon Lake. None of these lakes existed historically in Apache Highlands South. The lakes were created by manmade dams as water reservoirs and for sportfish recreation. Nonnative fish are managed in these lakes for sportfish recreation, and the wetland habitat is used by a variety of native wildlife species. Some nonnative species introductions have caused problems with wildlife and fish management (for example, crayfish, pike introduction into Parker Canyon Lake, bullfrog impacts to native amphibians). During drought some of these lakes have been greatly lowered.

Major Stressors Affecting Habitat (Element 3)

Stressor Category: **Abiotic resource use**

Mining
Groundwater depletion and springhead use
Water diversion/water catchments

Stressor Category: **Border issues**

Illegal dumping/littering along the border
Water use/contamination from illegal immigrants and drug smugglers
Unauthorized roads & trails created by illegal immigrants and smugglers
Disease along the border
Altered fire regime as a result of border activities
Enforcement activities along the border

Stressor Category: **Changes in Ecological Processes**

Altered river flow regimes
Unnatural fire regimes

Loss of keystone species
Management for game animals and sport fish
Habitat degradation/shrub invasions
Soil erosion
Habitat fragmentation/barriers
Streambank alteration/channelization

Stressor Category: **Climate Change**

Drought
Shift to warmer climate

Stressor Category: **Consumptive use of biological resources**

Grazing by ungulates

Stressor Category: **Habitat conversion**

Rural development
Recreational sites/facilities
Livestock management

Stressor Category: **Invasive species**

Disease/pathogens/parasites
Nuisance plants
Hybridization
Nuisance animals
Bait-bucket dumping/illegal stocking

Stressor Category: **Non-consumptive resource use**

Watercraft operation
Motorized recreation off-trail
Scientific research and collection

Stressor Category: **Pollution**

Sediment/ash flows
Lead shot/fishing line
Heavy metals/mine tailings
Pesticides/herbicides

Stressor Category: **Transportation and infrastructure**

Dredging

Stressors that act in this ecoregion at the species- but not habitat-scale (Element 3)

In some cases, a stressor may have significant impacts to individual SGCN, but impacts are not felt throughout the habitat. Regardless of the extent of ecosystem-wide impacts, in any habitat type where these stressors act on SGCN, the appropriate conservation actions apply (see "Conservation Actions to Address Stressors to SGCN (Elements 3, 4)"). The following stressors have significant ecosystem-level impacts in some habitat types in this ecoregion, but not in all habitat types where the SGCN occur. Note that for wide-ranging species, impacts from some stressors may be quite significant, but may not act on the species throughout its range.

Stressors that rated high for these SGCN, but not in some of the habitats in Apache Highlands South in which these species occur.

Stress Category	Stressor	Scientific Name	Common Name
Habitat conversion			
	Aquaculture		
		Kinosternon arizonense	Arizona Mud Turtle
	Wetland filling for mosquito control		
		Ardea alba	Great Egret
		Coccyzus americanus occidentalis	Western Yellow-billed Cuckoo
		Dendrocygna autumnalis	Black-bellied Whistling-Duck
		Egretta thula	Snowy Egret
		Gastrophryne olivacea	Great Plains Narrow-mouthed Toad
		Kinosternon arizonense	Arizona Mud Turtle
		Pternohyla fodiens	Lowland Burrowing Treefrog
Transportation and infrastructure			
	Railroads		
		Gopherus agassizii (Sonoran Population)	Sonoran Desert Tortoise
Border issues			
	Feral animals along the border		
		Trogon elegans	Elegant Trogon
	Poaching along the border		
		Gopherus agassizii (Sonoran Population)	Sonoran Desert Tortoise
		Leopardus pardalis	Ocelot
		Panthera onca	Jaguar
	Unauthorized roads & trails created for law enforcement along the border		
		Gyalopion quadrangulare	Thornscrub Hook-nosed Snake